

**We Claim:**

- 1           1.       An inshot gas burner for use in a furnace that includes  
2               a venturi tube having a converging inlet section and a diverging outlet  
3               section that communicates through a restricted throat wherein said angle of  
4               divergence of the outlet section is greater than  $4^\circ$  and further includes a generally  
5               cylindrical flame retainer housing at the exit of said outlet section which houses a  
6               flame retainer,  
7               a spud holder is axially aligned with said venturi tube adjacent to the  
8               entrance to the inlet section wherein the axial distance as measured over the spud  
9               holder and the flame retainer housing of the venturi tube is less than 5.00 inches and  
10              the burner capacity is between 5,000 and 5,800 Btus per unit length of burner per  
11              hour.
- 1           2.       The gas burner of claim 1 having a firing rate of at least 9,900 Btus  
2               per inch of diffuser length
- 1           3.       The gas burner of claim 1 wherein the throat has a diameter of about  
2               0.682 inches.
- 1           4.       The gas burner of claim 3 wherein the exit diameter of the diverging  
2               section of the venturi tube is about 1.44 times that of said throat.
- 1           5.       The gas burner of claim 4 wherein the entrance diameter of the  
2               converging section of the venturi tube is about 2.11 times that of the throat.
- 1           6.       The gas burner of claim 4 wherein the throat of the venturi tube is  
2               located an axial distance from the entrance to the venturi tube that is about 25% of  
3               the total combined axial length of the venturi tube and the flame retainer housing.

1           7.       The gas burner of claim 5 wherein the angle of divergence of the  
2       outlet section of the venturi tube is between 4° and 5°.

1           8.       The gas burner of claim 6 wherein the axial length of the flame  
2       retainer housing is at least 12% that of the combined length of the venturi tube and  
3       the housing.

1           9.       The gas burner of claim 2 wherein said flame retainer has an annular  
2       hub and a plurality of axially aligned splines that are equally spaced about the hub  
3       and has an inside diameter that is about 80% that of the throat diameter of the venturi  
4       tube.

1           10.      The gas burner of claim 9 wherein the outside diameter of the flame  
2       retainer is about equal to the exit diameter of the diverging section of the venturi  
3       tube.

1           11.      The gas burner of claim 10 wherein the axial length of the flame  
2       retainer is about one-third that of the outside diameter of the flame retainer.

1           12.      The gas burner of claim 2 wherein the flame retainer is an annular  
2       member having an inside diameter and an outside diameter and a series of through  
3       holes equally spaced about a hole circle centrally located between the outside  
4       diameter and the inside diameter.

1           13.      The gas burner of claim 12 wherein the outside diameter of the flame  
2       retainer is about 2.23 times that of the inside diameter.

1           14.      The gas burner of claim 13 wherein the outside diameter of the flame  
2       retainer is about 6.62 times that of each through hole.

1           15.     The gas burner of claim 14 wherein the flame retainer is about one  
2     third of its outside diameter.

1           16.     The gas burner of claim 1 wherein the overall length of the burner is  
2     less than 4.0 inches.

1           17.     An inshot gas burner unit for use in a furnace or the like that includes,  
2             a top plate having a plurality of axially aligned, spaced apart stampings, each  
3     of which describe the top half of a burner,  
4             a bottom plate having a plurality of axially aligned, spaced apart stampings,  
5     each of which describes the bottom half of a burner,  
6             means for joining together the two plates in face-to-face contact to establish a  
7     plurality of burners, each of which includes a spud holder having an entrance that is  
8     coextensive with one side edge of the cojoined plates, a venturi tube adjacent to the  
9     spud holder that includes a converging inlet section and a diverging outlet section  
10    that communicates through a restricted throat and an integral flame retainer housing  
11    at the exit of the diverging section that contains a cylindrical flame retainer, the exit  
12    of said flame retainer housing being coextensive with an opposing side edge of said  
13    plates, the angle of divergence of the outlet section being greater than 4°,  
14             said plates further including openings extending between the exit of each  
15    spud holder and the entrance to an adjacent venturi tube, and  
16             the axial length of each burner as measured over the spud holder and the  
17    flame retaining housing being less than 4 inches and each burner having a capacity  
18    of between 5,000 and 5,800 Btus per inches of length of burner per hour.

1           18.     The assembly of claim 17 further including crossover channels  
2     formed in one of said plates that extend between the diverging sections of adjacent  
3     venturi tubes.

1            19.    The assembly of claim 18 that further includes an igniter means for  
2    igniting gas at the outlet of one of said burners whereby the remaining burners are  
3    ignited through the connecting crossover channel.

1            20.    The burner assembly of claim 19 wherein said igniter means is  
2    associated with a first burner located at one end of the burner alignment and further  
3    includes a flame sensor operatively associated with a second burner located at the  
4    opposite end of the burner alignment.

1            21.    The burner assembly of claim 17 wherein the exit diameter of the  
2    diverging section of the venturi tube is about 0.98 inches.

1            22.    The burner assembly of claim 21 wherein the throat diameter of the  
2    venturi tube is between 0.65 inches and 0.70 inches.

1            23.    The burner assembly of claim 22 wherein the angle of divergence of  
2    the outlet section of the venturi tube of each burner is about between 4° and 5°.

1            24.    The burner assembly of claim 23 wherein the entrance diameter of the  
2    venturi tube of each burner is between 1.4 inches and 1.5 inches.

1            25.    The burner assembly of claim 24 wherein the combined length of the  
2    venturi tube and flame retainer housing of each burner is between 2.9 inches and 3.0  
3    inches.

1            26.    The burner assembly of claim 25 wherein the throat of the venturi  
2    tube of each burner is located between 0.690 inches and 0.710 inches from the  
3    entrance of the tube.

1           27.     The burner unit of claim 26 wherein the outside diameter of the flame  
2     retainer is about equal to the exit diameter of the venturi tube.

1           28.     The burner unit of claim 27 where the axial length of the flame  
2     retainer is about 0.38 inches.